

REGIONAL SAMPLE QUESTIONS

TOSS-UP

1) **BIOLOGY** *Multiple Choice* Which of the following is NOT caused by a bacteria:

- W) whooping cough
- X) scarlet fever
- Y) cat scratch fever
- Z) yellow fever

ANSWER: Z) YELLOW FEVER

BONUS

1) **BIOLOGY** *Short Answer* What are the predominant immunoglobulin classes produced during primary immune and secondary immune responses respectively?

ANSWER: IgM & IgG (ACCEPT: IMMUNOGLOBULIN M & IMMUNOGLOBULIN G)
(accept in any order)

TOSS-UP

2) **CHEMISTRY** *Multiple Choice* A molecule that has a central atom surrounded by 2 single bonds and 3 unshared pairs of electrons will most likely have which of the following shapes:

- W) square pyramidal
- X) seesaw
- Y) T-shaped
- Z) linear

ANSWER: Z) LINEAR

BONUS

2) **CHEMISTRY** *Short Answer* As predicted by the Periodic Table, arrange the following 4 elements in order of increasing electronegativity: sodium; hydrogen; magnesium; lithium

ANSWER: SODIUM; LITHIUM; MAGNESIUM; HYDROGEN

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3) PHYSICS *Short Answer* What stress is considered to be the exact opposite of tensile stress?

ANSWER: COMPRESSIVE

BONUS

3) PHYSICS *Short Answer* In a nucleus where a neutron changes to a proton, an electron, and an antineutrino, what specific type of decay has it experienced?

ANSWER: BETA MINUS

TOSS-UP

4) ASTRONOMY *Short Answer* If a star was named V332, what would the letter “V” indicate?

ANSWER: VARIABLE STAR (ACCEPT: VARIABLE, LUMINOSITY CHANGES, ETC.)

BONUS

4) ASTRONOMY *Short Answer* Which 2 of the following 5 stars are red giants or red supergiants: Sirius, Arcturus, Vega, Rigel, Betelgeuse

ANSWER: ARCTURUS; BETELGEUSE

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TOSS-UP

5) MATH *Short Answer* Convert $\frac{P}{10}$ radians into degrees:

ANSWER: 18°

BONUS

5) MATH *Short Answer* Simplify the following expression in its simplest radical form:
 $(2\sqrt{5} - 3)(4\sqrt{5} - 6)$

ANSWER: $58 - 24\sqrt{5}$

TOSS-UP

6) EARTH SCIENCE *Multiple Choice* Drumlins are most useful in determining:

- W) age of bacteria microfossils
- X) ice-age atmospheric conditions from wind deposited sediments
- Y) direction of a retreating glacier
- Z) farthest extent of spruce and pine forests

ANSWER: Y) DIRECTION OF A RETREATING GLACIER

BONUS

6) EARTH SCIENCE *Short Answer* During what Epoch of the Cenozoic Era was the most recent ice age on Earth?

ANSWER: PLEISTOCENE (ACCEPT: PLEISTOCENE ICE AGE)

REGIONAL SAMPLE QUESTIONS

TOSS-UP

7) GENERAL SCIENCE *Multiple Choice* In computer terminology, the acronym MAPI refers to:

- W) email
- X) graphics applications
- Y) storage
- Z) printing protocols

ANSWER: W) EMAIL

BONUS

7) GENERAL SCIENCE *Short Answer* What is the compiled format of Java programs that generally have a dot class extension?

ANSWER: BYTECODE

TOSS-UP

8) BIOLOGY *Multiple Choice* Which of the following will most likely give the best 3-D resolution of a rag weed pollen grain:

- W) bright field microscopy
- X) scanning electron microscopy
- Y) dark field microscopy
- Z) transmission electron microscopy

ANSWER: X) SCANNING ELECTRON MICROSCOPY

BONUS

8) BIOLOGY *Short Answer* What is the major muscle most typically involved in a rotator cuff problems in humans?

ANSWER: SUPRASPINATUS MUSCLE

REGIONAL SAMPLE QUESTIONS

TOSS-UP

9) CHEMISTRY *Short Answer* What is the general term for hydrocarbons that have rings but no multiple bonds?

ANSWER: CYCLOALKANES (ACCEPT: CYCLIC ALKANES)

BONUS

9) CHEMISTRY *Multiple Choice* Which of the following is a polar molecule:

W) KrF₂

X) OF₂

Y) CO₂

Z) BeH₂

ANSWER: X) OF₂

TOSS-UP

10) PHYSICS *Short Answer* The isotope of what element contributes the most in millirems of radiation exposure in the food of the average American?

ANSWER: POTASSIUM 40

BONUS

10) PHYSICS *Short Answer* Including friction, if the actual mechanical advantage of a ramp is 4, what is the efficiency of the ramp if it is 10 feet long and rises to 2 feet?

ANSWER: 80% (ACCEPT: 0.8)

REGIONAL SAMPLE QUESTIONS

TOSS-UP

11) ASTRONOMY *Multiple Choice* Alpha Centauri is best noted as the star cluster closest to the sun but it is actually made of:

- W) two yellow stars and a red dwarf
- X) one red giant and a brown dwarf
- Y) one super blue giant and two yellow stars
- Z) four yellow stars

ANSWER: W) TWO YELLOW STARS AND A RED DWARF

BONUS

11) ASTRONOMY *Short Answer* What is the name of the red dwarf orbiting the two yellow stars that are part of alpha Centauri?

ANSWER: PROXIMA CENTAURI

TOSS-UP

12) MATH *Multiple Choice* Which of the following algebraic expressions is NOT a polynomial:

- W) 2^5x^4
- X) $4x + 5x^3$
- Y) $4x^{-2}$
- Z) $x^2\sqrt{7} - xy + 3$

ANSWER: Y) $4x^{-2}$

BONUS

12) MATH *Short Answer* A fish swims downstream for 180 minutes. It turns around and swims against the same current and after 240 minutes it is still 6 miles short of its starting point. If the speed of the current was 4 miles per hour, what is the speed, in miles per hour, of the fish in still water?

ANSWER: 22 MPH

(Solution: $3(x + 4) = 6 + 4(x - 4)$; $x = 22$ mph)

REGIONAL SAMPLE QUESTIONS

TOSS-UP

13) EARTH SCIENCE *Multiple Choice* The slow circulation of the soft, gum-like rock within the asthenosphere, is accomplished by which of the following processes:

- W) conduction
- X) convection
- Y) radiation
- Z) insolation

ANSWER: W) CONDUCTION

BONUS

13) EARTH SCIENCE *Short Answer* Solar energy goes back to space from the Earth system in what two ways?

ANSWER: REFLECTION AND EMISSION (ACCEPT: REFLECTED AND EMITTED, ETC.)

TOSS-UP

14) GENERAL SCIENCE *Multiple Choice* Which of the following is the round magnetic plate that makes up part of a computer's hard drive:

- W) palette
- X) platform
- Y) platter
- Z) pancake

ANSWER: Y) PLATTER

BONUS

14) GENERAL SCIENCE *Multiple Choice* All the copper on Earth is believed by most scientists to have been originally created by which of the following:

- W) fusion in stars like our Sun
- X) fission in stars like our Sun
- Y) radioactive decay on Earth
- Z) supernova explosions

ANSWER: Z) SUPERNOVA EXPLOSIONS

REGIONAL SAMPLE QUESTIONS

TOSS-UP

15) BIOLOGY *Multiple Choice* Parkinson's is to the substantia nigra (read as: NEYE-grah), as Type 1 diabetes is to:

- W) panpiniform plexus
- X) pancreatic apha cells
- Y) islets of langerhans (read as: EYE-lets of LANG-er-hans)
- Z) glucose

ANSWER: Y) ISLETS OF LANGERHANS

BONUS

15) BIOLOGY *Short Answer* Based on what primary physical difference does gel filtration column chromatography separate proteins?

ANSWER: SIZE

TOSS-UP

16) CHEMISTRY *Short Answer* H_2O_2 is to the molecular formula of hydrogen peroxide as HO is to what?

ANSWER: EMPIRICAL FORMULA (ACCEPT: EMPIRICAL)

BONUS

16) CHEMISTRY *Multiple Choice* All single bonds are:

- W) pi bonds
- X) sigma bonds
- Y) omega bonds
- Z) delta bonds

ANSWER: X) SIGMA BONDS

REGIONAL SAMPLE QUESTIONS

TOSS-UP

17) PHYSICS *Multiple Choice* In what test of hardness does the size of an indentation in a material left by a steel ball give a measure of hardness:

- W) Whitworth scale
- X) Brinell test
- Y) Rockwell test
- Z) case test

ANSWER: X) BRINELL TEST

BONUS

17) PHYSICS *Short Answer* Rounded to the nearest whole number, what is the speed, in meters per second, of a 5 gram cherry revolving in horizontal uniform circular motion at the end of a 2 meter string with a frequency of 2 revolutions per second. Use pi rounded to the second decimal place.

ANSWER: 25

(Solution: $T = 1/2 = 0.5$; $V = (2)(\pi)(r)/t = (2)(3.14)(2)/0.5 = 25.12$)

TOSS-UP

18) ASTRONOMY *Multiple Choice* Which of the following is a far more comprehensive listing of celestial objects than the Messier catalogue:

- W) the 2000 Royal Astronomical sky survey
- X) the New General catalogue
- Y) the Index caelum
- Z) the Index Catalogue du Galactica

ANSWER: X) THE NEW GENERAL CATALOGUE

BONUS

18) ASTRONOMY *Multiple Choice* Most of the stars in the sky that appear to be single stars are actually:

- W) galaxies
- X) optical doubles
- Y) twins or triplets linked by gravity
- Z) large star clusters of thousands of stars

ANSWER: Y) TWINS OR TRIPLETS LINKED BY GRAVITY

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TOSS-UP

19) MATH *Short Answer* In terms of p , what angle between 0 and $2p$ is coterminal with $18p$?

ANSWER: 0

BONUS

19) MATH *Short Answer* Expand and simplify the following expression as completely as possible: $x^3 - y^3$

ANSWER: $(x - y)(x^2 + xy + y^2)$

TOSS-UP

20) EARTH SCIENCE *Multiple Choice* Which of the following is the best example of subsidence:

- W) snow avalanche
- X) beach erosion
- Y) collapse of an earthen dam
- Z) sinkhole

ANSWER: Z) SINKHOLE

BONUS

20) EARTH SCIENCE *Short Answer* Name the two main Periods, in order from the oldest to the most recent, that are subdivisions of the Cenozoic Era:

ANSWER: TERTIARY AND QUATERNARY (must be in order)

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TOSS-UP

21) GENERAL SCIENCE *Multiple Choice* Which of the following dietary sources provides the most docosahexa noic (read as: doe-KHO-sah-hex-an-oic) and arachidonic (read as: ah-RACK-ih-don-ic) acids needed for proper brain development:

- W) organ meats
- X) shellfish
- Y) non-organ meats
- Z) warm water fish

ANSWER: X) SHELLFISH

BONUS

21) GENERAL SCIENCE *Short Answer* What is the name of the program that a personal computer's microprocessor uses to get the computer system started after you power it up?

ANSWER: BIOS (ACCEPT: BASIC INPUT/OUTPUT SYSTEM)

TOSS-UP

22) BIOLOGY *Multiple Choice* What nucleated cell would be the most common in normal peripheral blood:

- W) erythrocytes
- X) monocytes
- Y) lymphocytes
- Z) eosinophiles

ANSWER: Y) LYMPHOCYTES

BONUS

22) BIOLOGY *Short Answer* What specific biome is often quite large, has a high mean temperature, high yearly rainfall, and poor soil?

ANSWER: TROPICAL RAIN FOREST

REGIONAL SAMPLE QUESTIONS

TOSS-UP

23) CHEMISTRY *Multiple Choice* Which of the following ARE considered chiral objects:

- W) balls
- X) screws
- Y) forks
- Z) nails

ANSWER: X) SCREWS

BONUS

23) CHEMISTRY *Multiple Choice* A molecule with sp hybridization has bond angles of:

- W) 90°
- X) 109.5°
- Y) 120°
- Z) 180°

ANSWER: Z) 180°

TOSS-UP

24) PHYSICS *Multiple Choice* Which of the following is the reverse of pair production:

- W) two photons act to produce an electron
- X) an electron and a neutrino produce a photon
- Y) an electron collides with a positron and mass is converted into energy of photons
- Z) an incident pair of photons cause the production of a pair of electrons and positrons

ANSWER: Y) AN ELECTRON COLLIDES WITH A POSITRON AND MASS IS CONVERTED INTO ENERGY OF PHOTONS

BONUS

24) PHYSICS *Short Answer* Given in Newtons, what is the centripetal force that is required to cause a 20 kilogram body to move at 2 meters per second in uniform circular motion with a radius of 5 meters?

ANSWER: 16 (ACCEPT: 16 NEWTONS)

(Solution: $CF = m v^2 / r = 20 \times 2^2 / 5 = 16$)

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25) BIOLOGY *Short Answer* The drug AZT primarily targets what enzyme peculiar to retroviruses?

ANSWER: REVERSE TRANSCRIPTASE

BONUS

25) BIOLOGY *Multiple Choice* What is the resting membrane potential in a typical human axon:

- W) 45 millivolts
- X) 0 millivolts
- Y) - 45 millivolts
- Z) -70 millivolts

ANSWER: Z) -70 MILLIVOLTS